THE SCIENCE WORLD
A Monthly e Magazine
ISSN:2583-2212
March 2024 Vol.4(3), 1067-1070
Popular Article

Anatomical Defence in Mammary Gland: An Overview

Monali B. Bhesaniya[1*], Vishnudeo Kumar[1], S. H. Zalavadiya[2]
[1]Department of Veterinary Anatomy, College of Veterinary Science and Animal Husbandry, Kamdhenu University, Junagadh, Gujarat-362001, India
[2]Department of Veterinary Surgery &Radiology, College of Veterinary Science &Animal Husbandry, Kamdhenu University, Junagadh, Gujarat-362001, India
https://doi.org/10.5281/zenodo.10854515

Introduction

The mammary gland of ruminants is the organ of extremely economic important due to the major role in providing nutrition source for a significant portion of the world's human population. Over past decades, milk production has dramatically increased in the whole world. Every attempt is being made to increase the productivity of the organ through research and advance management practices but at the same time subjecting it to the increased risk of infectious diseases like mastitis. One means of decreasing the impact of mastitis on the dairy industry is to increase the natural ability of the cow to resist the infections. This is a consequence of various defense systems collectively referred to as "resistance of the mammary gland to mastitis". Knowledge of these systems is incomplete and their interaction is often unknown. Their effectiveness is subject to anatomical, cellular, histochemical and biochemical influences.

Mammary Gland Immunity

The mammary gland is protected by a variety of defense mechanisms, which can be separated into two distinct categories: innate immunity and specific immunity.

Innate immunity, also known as nonspecific responsiveness, is the predominant defense during the early stages of infection. Nonspecific responses are present or are activated quickly at the site of infection by numerous stimuli; however, they are not augmented by repeated exposure to the same insult. Nonspecific or innate responses of the mammary gland are mediated by the anatomical barrier of the mammary gland, macrophages, neutrophil, natural killer (NK)-like cells, and by certain soluble factors.

The anatomical factors related to the mastitis resistance are teat sphincter muscle, teat keratin, teat cistern lining, teat shape, teat length, teat diameter, Furstenberg's rosette, teat

Official Website
www.thescienceworld.net
thescienceworldmagazine@gmail.com
Published 22.03.2024

pigmentation, teat skin, size of alveoli etc. Cellular factors responsible for mammary gland protection are epithelial lining and immunological cell population like various leukocytes.

Anatomical Defense of mammary gland

Teat sphincter muscle

The teat end contains sphincter muscles that maintain tight closure between milkings and hinder bacterial penetration. Increased patency of these muscles is directly related to increased incidence of mastitis. Teat closure after milking, effected by the local teat musculature, is paramount for inhibiting bacterial entrance. However, some closure is achieved 20 to 30 minutes after completion of milking; during that period animals should be prevented from lying down, as this predisposes to increased exposure of their teats to bacteria.

Teat keratin plague

The teat canal is lined with keratin, which is crucial to the maintenance of the barrier function of the teat end, and removal of the keratin has been correlated to increased susceptibility to bacterial invasion and colonization Teat keratin is a waxy material that is derived from stratified squamous epithelium. The keratin structure enables trapping of invading bacteria, thus hindering their migration into the gland cistern. Antimicrobial agents have been identified within the keratin lining. The esterified and non-esterified fatty acids present in teat keratin, such as myristic acid, palmitoleic acid, and linoleic acid, are bacteriostatic. During the dry-period, accumulation of keratin at the teat orifice seals the teat preventing bacterial entrance.

Keratohyalin granules of stratum granulosum of teat canal contributed in formation of large amount of keratin in lumen of streak canal. Keratin formed a mesh like substance at the lumen of streak canal, thus partially occluded lumen and inhibits bacterial penetration by providing physical barrier.

Teat cistern lining

The teat cistern is lined with cuboidal epithelium, that is, a double layer of ‘block’ cells. In the normal cow these are held tightly together however, in response to bacterial invasion, they have the ability to move slightly apart, which allows the entry of infection-fighting white blood cells from the small blood vessels beneath.

Furstenberg's rosette

The *Furstenberg's rosette* is located in the internal streak canal of the teat. It radiates upward into the teat cistern. It often is considered a barrier for pathogens, yet it offers little resistance to milk leaving the teat. the larger surface area provided by connective tissue folds of Furstenberg's rosette provided more surface area for infiltrating leucocytes for phagocytosis of bacteria.

Official Website
www.thescienceworld.net
thescienceworldmagazine@gmail.com
Published 22.03.2024

Teat length & Diameter

cows with teats of smaller diameter milked more completely. incidence of mastitis increased proportionally to teat diameter. Animal with Medium-to-short teats has lowest incidence of mastitis. The shortened teats are less prone to physical trauma, whereas long teats increase the risk of accidental trauma and these lesions constitutes potential source of microorganism which increase the probability of udder infection. The risk of subclinical mastitis was highest for cows with long and thick teats.

Teat shape

Funnel-shaped teats offered greater resistance to being drawn into the teat cup and appeared to milk out more completely. On cylindrical and bottle-shaped teats, the teat cups caused occlusion of the orifice between the gland sinus and teat sinus, causing a decrease and then complete stoppage of milk flow. This may cause traumatization of the teat-end orifice. There exists for cylindrical rear teats a significantly greater incidence of mastitis than for funnel- and bottle-shaped rear teats. The risk of subclinical mastitis for cows with funnel shaped teats was found to be lower than cows with cylindrical teats.

Teat pigmentation

Cows with lighter skin pigmentation about the udders and teats appeared to be more susceptible to irritation of teat skin from harsh environment, whereas animal with dark pigmented skin on teat and udder have ability to withstand against harsh environment.

Teat skin

Fatty acids present on the teat skin have bacteriostatic properties and can thus limit bacterial numbers around the teat orifice and on the teat surface.

Size of alveoli / Thickness of septa

Udder with small size alveoli have more amount of interalveolar connective tissue, whereas udder with larger size alveoli have very less amount of interalveolar connective tissue. The amount of interalveolar connective tissue was found to be more in the mammary gland of non-de script cow in comparison to that of crossbred cow. Thickness of the interalveolar barrier which included the alveolar epithelial cells of two adjacent alveoli and the connective tissue element in between them was about more in nondescript cow than in crossbred cow. This thickness was taken into consideration for the probable propagation of the infective agents into the surrounding alveoli on the occasion of the entry of mastitis causing organisms into the mammary gland. It may therefore be concluded that the chances of interalveolar spreading of infection in the mammary gland of non-descript cow is far less in comparison to that of crossbred cow.

Official Website
www.thescienceworld.net
thescienceworldmagazine@gmail.com
Published 22.03.2024

Udder attachment

The tighter udder attachment indicated lesser chances of mastitis (Rupp and Boichard, 1999). Therefore, higher incidence of tight udder attachment in non-de script and crossbred cows might be one of the causes of lower frequency of mastitis. The udder attachment is heritable character and heritability of udder traits is moderate to high therefore, indirect selection for tight udder attachment may be considered to reduce the chances of mastitis.

Udder cleft

The deeper udder cleft showed lesser chances of mastitis, hence higher incidence of deeper udder cleft was one of the causes of lower incidence of mastitis in non-descript cows in comparison to crossbred cows. So deep udder cleft or crease may be taken in to consideration as indirect selection parameter during the formulation of breeding programme to reduce the chances of mastitis.

Udder quarter

The higher frequency of equal quarter might be one of the factors for lesser incidence of mastitis in non-descript cow. Therefore, this trait may be considered as indirect parameter during selection for crossbreeding programme to get more resistance to mastitis.

In conclusion, the interplay of various anatomical factors is pivotal in bolstering the mammary gland's resilience against mastitis in ruminants. By comprehensively understanding these defenses, researchers and dairy farmers can devise targeted strategies to enhance mastitis resistance in cattle populations. Incorporating these anatomical traits into breeding programs holds promise for reducing mastitis incidence and ultimately improving the health and productivity of dairy herds worldwide.

Official Website
www.thescienceworld.net
thescienceworldmagazine@gmail.com
Published 22.03.2024